Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Considering the wide and even tropical distribution of *V. cardui* in the Old World, its absence from South America seems not a little remarkable. But the species of cosmopolitan genera not very rich in species (like Vanessa) are generally conterraneous, or they occupy adjoining zoölogical provinces as equivalent species, species of replacement, or, as the Germans sometimes call them, vicarious species. But we have already seen that, if we leave out of account our cosmopolitan species, and restrict *V. Atalanta* to the Old World, where it actually belongs, each of the species of Vanessa occupies a separate zoölogical region, one adjoining another, over nearly the entire extent of either world. The cosmopolitan species, similarly restricted to the New World as its proper habitat, occupies nearly the same region as *V. Huntera*, extending no doubt farther north, and becoming less abundant toward the southern extremity of the common limits of the two, phenomena which are repeated in the distribution of our two common and wide-spread eastern species of *Argynnis*, *A. Cybele*, and *A. Aphrodite*. The absence of *Vanessa cardui* from South America is therefore rather an argument in favor of its American origin. The presence of the insect on the shores of Behring's Straits, as testified by Wagner, is an indication of its route from America to Asia; and this passage must have taken place in times so far distant that it has had opportunity to push its way even to Australia and New Zealand, and there to become so modified as to establish a peculiar race, once dignified by a specific name. If its presence in the Hawaiian Islands can be proved, such a fact would be more difficult to understand; but we can hardly doubt that *V. Tammeamea* and the other Old World species of Vanessa sprang from one original stock; and if the progenitors of the Hawaiian Islands species found a track from the Asiatic continent, so, plainly, could *Vanessa cardui*.

◆

THE LOBSTER; ITS STRUCTURE AND HISTORY.

BY J. S. KINGSLEY.

As the season of summer schools is approaching, it has been thought advisable to give a short account of the anatomy of the lobster. This animal has been chosen not only on account of its size and the ease with which either it or its fresh-water cousin, the crayfish, can be obtained, but also from the intermediate position it occupies in the articulata, forming an important type of this branch of the animal kingdom. A few technical terms have been employed, since there is a lack of common names, to aid in explaining the homologies of the various parts.

At the first glance the lobster is seen to consist of a large anterior portion, bearing the pincers and various other appendages; and a posterior jointed portion, the abdomen. Taking the third segment (*somite*) of the abdomen as a starting-point, it is seen to consist of an upper (*tergal*) and an under (*sternal*) portion. The portion of the segment between these two is called the *pleurum*. On the under side, inserted between the sternum and pleurum, is seen a pair of appendages, the swimmerets (*pleopoda*). Each consists of a basal portion (*protopodite*) and two oval fringed paddles, of which the inner is the *endopodite* and the outer the *exopodite*. This we will consider as our typical segment, that is, we will try to show that all the other somites are formed on the same plan, with more or less variation of detail. In the sixth abdominal segment these swimmerets will be seen to be greatly enlarged, and the exopodite has a transverse joint. The seventh or last segment (*telson*) has no appendages. Together with the pleopoda of the sixth it forms a paddle by which the animal is enabled to propel itself backward in the manner familiar to all who have ever observed these animals when alive. The pleopoda of the first abdominal somite are also modified; in the female they are small, slender, and soft; in the male each consists of a hard protopodite and endopodite, the exopodite being absent. The endopodite of the second segment in the male lobster bears an additional joint on the inner side.

We now come to the anterior portion of the body, in which the segments are not so distinctly marked. It is covered with a large dorsal shield, the *carapace*. In front it is produced, between the eyes, into a long spine, the *rostrum*. In the middle is a groove which indicates the position of the heart in the interior. It certainly does not indicate the line of separation of the head and thorax.

We are enabled to separate the anterior portion into somites from the fact that for every pair of jointed appendages there is a corresponding segment. Proceeding forward from the abdomen with our homologies, we first find the fifth or last thoracic limb, which differs greatly at first sight from the swimmerets. It consists of a protopodite and a jointed endopodite; in its earlier stages it had also an exopodite. With the thoracic limbs a new feature appears; to the limb or the sternum at the base of the limb are attached one or more conical appendages consisting of little lamellæ fastened together, forming a gill. These gills are packed away under the carapace. There are twenty on each side. The fifth limb bears one. In the fourth we find still another organ, a thin leathery structure with scattered hairs, the *epipodite*, the function of which is to keep the gills apart. This limb bears four gills, as do the third and second. In the second and third limbs the inner distal angle of the next to the last joint is greatly elongated, forming with the last joint a pincer or *chela;* limbs thus formed are said to be *chelate*. The first pair of thoracic limbs are greatly enlarged, and it is the outer instead of the inner angle of the joint next to the last which is elongated to form the pincer. It bears three gills.

We now come to the appendages of the head, and among them we again find the exopodite. The six posterior pairs are commonly called the "mouth parts." We first find, in going forward, three pairs of *maxillipeds*, each composed of a protopodite, exopodite, and endopodite. The outer pair are larger than the others, the basal joints are hard and toothed like a saw; they bear each three gills. The second pair bear one small gill and the third are gilless. In front of the maxillipeds are the two pairs of maxillæ. They are delicate, almost membranous. The epipodite of the posterior one, called *scaphognathite*, is in life in constant motion, baling out water from the gill cavity, thus creating a current over the gills and aiding in respiration. We next come to the mandibles, a pair of hard protopodites with cutting edges, and a delicate three-jointed endopodite termed a *palpus*. Between the mandibles is the mouth. It is bounded behind by a bifurcated process, the *metastoma*, and in front by a simple enlargement, the *labrum*. In front of the mouth the sternal surface bends abruptly upward. Above this flexure we find the larger antennæ, which consist of a protopodite and endopodite, the exopodite being represented by a small spine. Still farther in advance are the smaller antennæ, called the antennulæ. This finishes the number of segments. Reviewing, we see that we have eight cephalic, five thoracic, and seven abdominal. It will be seen that the writer does not recognize any segment corresponding to the eyes, and that he believes the telson to be a somite. The reasons for the former are chiefly embryological; for the latter, the fact that the intestine passes through it, together with certain reasons derived from the development of the young lobster. The mere absence of appendages has no great weight.

The internal anatomy is best studied by removing part of the carapace and tergal portions of the abdominal segments, as shown in the plate, taking care not to injure the underlying organs. Beneath the shell will be found a reddish membrane, which must also be carefully removed. The heart will be seen to be an irregular hexagonal body, lying just behind the suture noticed in speaking of the carapace. It consists of a single ventricle contained in a sac improperly called the *pericardium.* It gives off in front an artery to the eyes and anterior part of the body. Close to this on each side is the hepatic artery. On the under side is the sternal artery, while from the posterior angle arises the artery which supplies the abdomen. The sternal artery connects with one which runs the length of the body on the under side. Respiration is carried on in the gills. The heart forces out through these various arteries the blood, which collects in a *venous sinus*, passes to the gills, and then back to the heart.

In front of and surrounding the heart is a delicate, convoluted mass, the liver, which occupies a large proportion of the thoracic cavity. In it are imbedded two elongated bodies, *ovaries* or *testes*, according to the sex, which pass under the heart. They are connected in front of the heart. Behind this connection are the *oviducts* of the female or *vasa deferentia* of the male.

The mouth, the position of which has been noticed, is connected with the œsophagus, which in turn empties into the stomach. This latter is a large sac in the anterior part of the body, and consists of anterior and posterior (*cardiac* and *pyloric*) portions. In the cardiac is a complex calcareous organization operated by powerful muscles, the office of which is to finish the mastication of the food. In the pyloric portion is a ciliated strainer. The intestine is a straight tube extending beneath the heart from the pylorus to the anus, which is situated on the under side of the telson. At the base of each antenna is the "green gland," supposed to be a kidney; it communicates with the exterior by an opening in the protopodite.

The "brain" is found at the base of the rostrum, between the eyes. It gives off nerves to the eyes, the antennulæ and the antennæ. From the posterior portion are given off two commissures, which pass around on either side of the œsophagus and unite in a ganglion behind. To examine this and the succeeding thoracic ganglia, it will be found necessary to carefully break down part of the sternum. From each of the œsophageal commissures arises a nerve, the two uniting in front of the stomach and giving rise to the sympathetic nerve. From the infra-œsophageal ganglion arise the nerves which go to the mouth parts. The thoracic ganglia are connected by two commissures, the abdominal by a single cord. The sternal artery passes between the commissures, uniting the third and fourth thoracic ganglia. There is no ganglion for the telson.

The only senses which are localized in the lobster are sight and hearing. The position of the eyes has been noticed ; the ear is found as a small sac in the base of the antennulæ.

Space will allow but a slight account of the development ; for details the reader is referred to the papers of Mr. S. I. Smith, in Verrill and Smith's Report on the Invertebrata of Vineyard Sound, and in the Transactions of the Connecticut Academy of Science. (See also the NATURALIST, July, 1874.) The eggs are of a dark green color, and are found from April to November on the coast of New England. The embryo in the egg has its eyes sessile, its antennæ are simple sacs, and its abdominal feet are wanting. In the first stage after leaving the egg the thoracic feet are furnished with an endopodite fringed with hairs. The animals then swim on the surface. In the second stage some of the abdominal appendages appear. In the third it loses its exopodites, and begins to resemble the adult. Specimens three inches long have been found with nearly all the characters of the adult. During the first year the molts are quite frequent, but afterwards they are believed to occur but once a year. The carapace splits down the back, and through the opening the animal withdraws itself, leaving its œsophagus and stomach within the cast-off skin, and in a few days the new skin becomes hardened.

EXPLANATION OF PLATES V. AND VI.

Plate V. Fig. 1, carapace ; 2–8, abdominal segments ; 2′, side view of the first abdominal somite of male ; 9, antennulæ ; 10, antennæ ; 11, mandibles ; 12, 13, maxillæ ; 14–16, maxillipeds ; 17, big pincer ; 18–21, remaining thoracic feet ; 22, front view of third abdominal segment ; 23, transverse section through the carapace.

Plate VI. Fig. 1, dorsal view, part of the carapace removed, giving a schematic view of the internal anatomy, a portion only of each organ being represented ; 2, nervous system ; 3, diagramatic figure of the circulation (from Gegenbauer) ; 4, embryo in the egg (from Smith) ; 5, first stage of young (from Smith).

E, eye ; ex, exopodite ; en, endopodite ; ep, epipodite ; f, flexor muscles ; g, gill ; h, heart ; h. a, hepatic artery ; i, intestine ; l, liver ; m. a, anterior median artery ; n, nerve ; p, protopodite ; p. a, posterior artery ; p. c, pericardium ; r, rostrum ; s, stomach ; t, ovary or testes ; v. a, ventral artery ; s. a, sternal artery : v. s, venous sinus ; x, extensor muscles.